HW Solution

24.52 & 24.66

24.52 (a) $C_0 = \varepsilon_0 \frac{A}{d}$

$K = \frac{C}{C_0} \qquad C = kC_0 = k\varepsilon_0 \frac{A}{d}$

$\frac{C}{A} = \frac{k\varepsilon_0}{d} = \frac{10 \times 8.85 \times 10^{-12}}{7.5 \times 10^{-9}} = 1.18 \times 10^{-2}\ F/m^2$

(b) $E = \frac{V}{d} = \frac{85mV}{7.5nm} = \frac{8.5 \times 10^{-2} V}{7.5 \times 10^{-9} m} = 1.13 \times 10^{7}\ V/m$

24.66 (a) $\frac{1}{C_{eff}} = \frac{1}{C_1} + \frac{1}{C_2} = \frac{1}{C_1} + \frac{1}{C_1} = \frac{2}{C_1}$

$C_1 = \frac{\varepsilon_0 A}{\frac{d-a}{2}} = \frac{2\varepsilon_0 A}{d-a}$

$C_{eff} = \frac{C_1}{2} = \frac{\varepsilon_0 A}{d-a}$

(b) $C_{eff} = \frac{\varepsilon_0 A}{d} \cdot \frac{d}{d-a} = C_0 \frac{d}{d-a} = \frac{dC_0}{d-a}$

(c) $a \to 0 \qquad C_{eff} \to \frac{dC_0}{d} \to C_0$ the very thin metal has no effect.

$a \to d \qquad C_{eff} \to \infty$

For a given potential difference, Q is large when y is small